

What is claimed is:

1. An expression vector comprising a nucleic acid sequence which encodes a mammalian Na<sub>v</sub>1.9 sodium channel protein or a fragment thereof, wherein the expression vector produces a sodium current when transfected in a cell.

2. The expression vector of claim 1, wherein the mammalian Na<sub>v</sub>1.9 is selected from the group consisting of human, rat and murine Na<sub>v</sub>1.9.

3. The expression vector of claim 2, wherein the rat Na<sub>v</sub>1.9 comprises an amino acid sequence selected from the group consisting of:

- (a) amino acid residues 1 to 1765 of SEQ ID NO: 2,
- (b) an amino acid sequence comprising a fragment of amino acid residues 1 to 1765 of SEQ ID NO: 2, and
- (c) amino acid residues 1 to 1765 of SEQ ID NO: 2 comprising at least one conservative substitution.

4. The expression vector of claim 2, wherein the human Na<sub>v</sub>1.9 comprises an amino acid sequence selected from the group consisting of:

- (a) amino acid residues 1 to 1791 of SEQ ID NO: 4,
- (b) an amino acid sequence comprising a fragment of amino acid residues 1 to 1791 of SEQ ID NO: 4, and
- (c) amino acid residues 1 to 1791 of SEQ ID NO: 4 comprising at least one conservative substitution.

5. The expression vector of claim 2, wherein the murine Na<sub>v</sub>1.9 comprises an amino acid sequence selected from the group consisting of:

- (a) amino acid residues 1-1765 of SEQ ID NO: 6,
- (b) an amino acid sequence comprising a fragment of amino acid residues 1-1765 of SEQ ID NO: 6, and
- (c) amino acid residues 1-1765 of SEQ ID NO: 6 comprising at least one conservative substitution.

6. The expression vector of claim 1 that is an expression plasmid.

7. The expression plasmid of claim 6 that is a low copy number expression plasmid.

8. The expression plasmid of claim 7 further comprising a promoter sequence operably linked to the Na<sub>v</sub>1.9 sequence.

5 9. The expression plasmid of claim 8, wherein the promoter sequence is a CMV promoter.

10. The expression plasmid of claim 8 further comprising a selectable marker under the control of a second promoter sequence.

10 11. The expression plasmid of claim 10, wherein the selectable marker is a neomycin resistance gene.

12. The expression plasmid of claim 7, wherein the Na<sub>v</sub>1.9 is rat Na<sub>v</sub>1.9 and wherein the rat Na<sub>v</sub>1.9 comprises SEQ ID NO: 20.

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13. The expression plasmid of claim 12, further comprising at the 5' end adjacent to the open reading frame encoding said SEQ ID NO: 2 at least about 1-100 of the untranslated nucleic acid residues which are 5' to the open reading frame of SEQ ID NO: 19.

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14. The expression plasmid of claim 13, comprising at least about 1-50 of said 5' untranslated nucleic acid residues.

15. The expression plasmid of claim 14, comprising 38 of the 5' untranslated nucleic acid residues.

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16. The expression plasmid of claim 15, wherein the expression plasmid is prNaN.

17. A recombinant cell comprising a plasmid selected from the group consisting of prNaN and a plasmid of claim 12.

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18. The expression plasmid of claim 13, further comprising a nucleic acid sequence which encodes a histidine tag sequence wherein the expression of the tag is under the control of the same promoter which controls expression of the open-reading frame.

19. The expression plasmid of claim 18, further comprising a nucleic acid sequence which encodes a green fluorescent protein (GFP) label polypeptide wherein the expression of the GFP is under the control of the same promoter which controls expression of the open reading frame.

5 20. The expression plasmid of claim 19, which is pCMV-rNaN-GFP.

21. A recombinant cell comprising a plasmid selected from the group consisting of pCMV-rNaN-GFP and a plasmid of claim 19.

10 22. An expression plasmid comprising a nucleic acid sequence which encodes a mammalian Na<sub>v</sub>1.9 sodium channel protein or a fragment thereof, wherein the mammalian Na<sub>v</sub>1.9 sodium channel protein or fragment thereof comprises SEQ ID NO: 2 with at least one mutation selected from the group consisting of: a serine to proline change at amino acid position 962, a leucine to proline change at amino acid position 1282 and a deletion of amino acid residues 1000-1010.

15 23. The expression plasmid of claim 22, wherein the expression plasmid is pLG338XM-rNaN.

20 24. A recombinant cell comprising a plasmid selected from the group consisting of pLG338XM-rNaN and a plasmid of claim 22.

25. A method of making a cell or cell line that produces a Na<sub>v</sub>1.9 sodium channel-dependent sodium current comprising:

25 (a) providing a cell which has been transfected with an expression vector which comprises a nucleic acid sequence which encodes the Na<sub>v</sub>1.9 sodium channel protein, and

(b) culturing said cell under conditions which allow expression of the Na<sub>v</sub>1.9 sodium channel protein to produce a sodium current in the transfected cell.

30 26. The method of claim 25, wherein the mammalian Na<sub>v</sub>1.9 is selected from the group consisting of human, rat and murine Na<sub>v</sub>1.9.

27. The method of claim 26, wherein the expression vector is an expression plasmid.

35 28. The method of claim 27, wherein the expression plasmid is selected from the group consisting of prNaN, pCMV-rNaN-GFP and a plasmid comprising SEQ ID NO: 19.

29. A method of screening for an agent that modulates sodium current in a cell comprising:  
(a) exposing the cell or cell line produced by the method of claim 25 to the agent; and  
(b) measuring sodium current following exposure to the agent, wherein an alteration in the level of sodium current is indicative of an agent capable modulating sodium current in a cell.

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30. A recombinant cell comprising the expression vector of claim 1.

31. The expression vector of claim 1, wherein the vector is a viral vector.

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32. The viral vector of claim 31, wherein the viral vector is selected from the group consisting of adenovirus, adeno-associated virus and baculovirus.

33. A recombinant cell comprising the viral vector of claim 31.